NAFINDEX: Measure of Financial Inclusion based on NABARD All India Rural Financial Inclusion Survey (NAFIS) Data

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Abstract

Financial inclusion (FI) is a multi-dimensional phenomenon unlike its pre-cursor concepts of access to credit or access to savings bank account which define financial inclusion in a narrow sense. Hence, measuring financial inclusion is complicated and requires developing a suitable index. Several scholars developed FI index mostly following methodology of Human Development Index. Sharma (2008), Mehrotra (2009), Ambarkhane *et al.* (2012), Gupte *et al.* (2012), Goel and Sharma (2017) are a few of them. CRISIL's Inclusix is an index at district level. Department of Financial Services (DFS), Ministry of Finance, Government of India also is constructing an index of financial inclusion to help monitoring over the years. These indices covered different dimensions. All these indices are constructed using data from secondary sources and measure supply side access. That is, they mainly represent the access an individual can have. Actual use of a financial service by an individual or household is not reflected in these indices. World Bank's Findex is one index developed based on survey data of individuals. We recommend that a FI index should manifest the actual usage of financial services in terms of breadth, intensity and extent of digital penetration. We, therefore, propose NAFINDEX, based on state-wise household level access to financial services based on data from NABARD All India Rural Financial Inclusion survey (NAFIS). Based on the field level data collected through NAFIS 2016-17, NAFINDEX has been constructed for different states of India. Three dimensions, traditional banking products, modern banking products, and payment systems, are considered for constructing the index. The average value of index at all India is 0.337. There are variations across states in the value of NAFINDEX and dimension indices. Interestingly, many states which saw lower penetration of traditional banking products as reflected in the respective dimension index, the modern banking products and payment mechanisms showed higher values. This underlines the direction for the future banking expansion in hither to unreached states.

Key words: Financial inclusion; Index; NAFINDEX

1. Introduction

Financial inclusion is increasingly being recognized world over as a key driver of economic growth and poverty alleviation. Apart from these benefits, financial inclusion (FI) imparts formal identity, provides access to the payments system and to savings safety net like deposit insurance, and enables the poor to receive direct benefit transferred in a leak-proof

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manner. At a macro level, greater FI is considered crucial for sustainable and inclusive socio economic growth for all. However, the FI is not an end in itself as it is only a means to reach higher levels of development. The potential for development in the various sectors of the economy such as primary sector (agriculture and allied sectors) and Micro, Small and Medium Enterprises (MSME) sector is enormous. However, the limited access to affordable financial services such as savings, loan, remittance and insurance services by the vast majority of the population in the rural areas and unorganised sector is believed to be acting as a major constraint to the growth impetus in these sectors. It is widely believed that access to affordable financial services - especially credit and insurance - enlarges livelihood opportunities and empowers the poor to take charge of their lives. Such empowerment also adds to social and political stability in the economy.

2.   What is Financial Inclusion?

With an objective to extend such financial services to a sizeable majority of population particularly who continue to remain excluded from the opportunities and services provided by the financial sector, a Committee on Financial Inclusion (CFI) was set up by the Govt. of India under the Chairmanship of Dr. C. Rangarajan in 2006. This Committee on Financial Inclusion (Rangarajan, 2008) defined Financial Inclusion as:

> "*process of ensuring access to financial services and timely and adequate credit where needed by vulnerable groups such as weaker sections and low income groups at affordable costs."*

The report identified demand and supply sides of financial services and emphasised on improving human and physical resource endowments. Subsequently, Planning Commission, Govt. of India (2009) in a Report of the Committee on Financial Sector Reforms mentioned:

> "*Financial Inclusion is not only about credit but involves a wide range of Financial Services including savings accounts, insurance and remittance products. Moreover, credit provision without adequate measures to create livelihood opportunities and enhance credit absorption amongst poor will not yield desired results."*

Emphasizing the importance of those financial products, the report recommended that access to safe and remunerative methods of savings, remittances, insurance and pension need to be expanded. They suggested crop insurance for farmers and health insurance for the poor as vulnerability reducing instruments.

The recent developments in banking technology have transformed banking from the traditional brick-and-mortar infrastructure like staffed branches to a system supplemented by other channels like automated teller machines (ATM), credit/debit cards, internet banking, online money transfers, mobile money, UPI, *etc*. The moot point, however, is that access to such technology is restricted only to certain segments of the society. Indeed, some trends, such as increasingly sophisticated customer segmentation technology – allowing, for example, more accurate targeting of certain sections of the market – have led to restricted access to financial services for some groups. There has been a growing divide, with an increased range of personal finance options for a segment of high and upper middle-income population on one hand and a significantly large section of the population who lack access to even the most basic banking services on the other. This is termed "financial exclusion". These people, particularly, those living on low incomes, cannot access mainstream financial

products such as bank accounts, credit, remittances and payment services, financial advisory services, insurance facilities, etc. The essence of financial inclusion is in trying to ensure that a range of appropriate financial services is available to every individual and enabling them to understand and access those services. Total financial inclusion or "Sampoorn Viteeyea Samaveshan" (SVS) envisaged to cover six broad areas, *viz.*, (1) Ensuring every district with 1,000-5,000 households had access to banking services within 5 kms by March 2016; (2) Provide financial literacy; (3) Provide basic banking for all beneficiaries of government schemes by March 2016; (4) An overdraft of Rs. 5,000; (5) Micro insurance; and (6) Pension scheme for the unorganized sector (Mehta and Shah, 2014). Now the question arises, how do we get to know the level of financial inclusion of a population in a geography? This necessitates measurement of level of financial inclusion through an objective tool say financial inclusion index.

3.   Why Financial Inclusion Should be Measured?

Financial inclusion is a key policy area and the central banks world over has an interest in it. Greater financial inclusion is essential for sustained economic welfare and for reducing poverty. It also supports economic, monetary and financial stability, by making saving and investment decisions more efficient, enhancing the effectiveness of monetary policy instruments, and facilitating the functioning of the economy (IFC Bulletin No. 38, Bank for International Settlements). In turn, economic stability helps to develop and strengthen a smoothly functioning financial system that can support financial inclusion. Therefore, it is very essential to measure financial inclusion objectively.

4.   How to Measure Financial Inclusion?

Now, the question arises, how we measure financial inclusion. Financial inclusion is a multi-dimensional phenomenon and hence, its measurement remains inadequate if crucial dimensions are not included. Further, data on various indicators of financial inclusion raise important issues. Well-founded data frameworks are essential while developing financial services for the poor, in both formal and informal markets. Appropriate indicators in adequate number are a precondition for good financial inclusion measurement. They ensure that financial inclusion is properly assessed and that policies aimed at it are adequately implemented, monitored, and adjusted as required. Good statistics can also help to strike a fine balance between encouraging innovation and the growth of financial services on the one hand, and ensuring that financial stability is preserved, on the other.

5.   Developing Indices of Financial Inclusion

Measurement of financial inclusion could be done through developing a suitable financial inclusion index (FII). A composite financial inclusion index, provides scope for multiple dimensions of financial inclusion to be reduced to a single one, making it simpler for analysts and policymakers alike. In general, such indices have no units and are constructed by making all the measured dimensions comparable. Such an index can be a valuable instrument to diagnose the financial inclusion situation for a specific geographic location, and to facilitate spatial and temporal comparisons. In turn, the index based on a set of identified key performance indicators can be established as a benchmark and used to identify best practices. Nevertheless, FII cannot be considered as a universal or exclusive policy tool. In fact, developing composite index is not a goal in itself. The quality of underlying data, however, is crucial.

Once we construct an index and measure financial inclusion, we can strive to achieve beyond its benchmark level. However, how do we measure financial inclusion depends on how we define it. In India, there have been several attempts to measure financial inclusion based on proportion of adult population having access to formal banking system, proportion of adults having bank account, bank accounts per 1000 adult population, ATMs per 1000 sq. km, population being serviced per branch, etc. However, all these are supply-side factors determining the status of financial inclusion. Similarly, there are demand-side factors such as income level, credit absorption capacity, financial awareness and literacy level of people, availability of livelihood opportunities in the area, etc. which determine the level of financial inclusion of a particular geography. Further, the quality of financial services being supplied and availed is another dimension determining the quality of financial inclusion. Thus, financial inclusion is a multi-dimensional phenomenon that can be better summarised by a composite index. The financial inclusion index (FII) should be such that: (i) it represents the true situation as far as possible; (ii) it is simple and easy to compute so that it is amenable for comparison; (iii) it should have meaningful bounds (say 0 and 1); and (iv) it should have monotonicity (higher values indicating higher level of financial inclusion).

There are 4 Steps to be followed in constructing FII. Develop a clear theoretical framework, to begin with, to have a sound basis for selecting the individual indicators of interest. Second, define precisely the data content, analysis, weighting and aggregation scheme for the selected indicators. Third, conduct sensitivity and robustness analysis to ensure quality. For instance, the indicator should not change dramatically if one of the individual components is excluded, or if a different scheme of weights is used. Lastly, create a framework for representing and communicating information provided by an FII, especially when making cross-country comparisons on the overall performance of the index, and the contribution of the various indicators to it.

6.   Various Approaches to Construction of Index of FI

FI index is constructed using multi-dimensional framework representing demand and supply factors. Beck, Kunt and Peria (2007) make a clear distinction between (1) access and the possibility of use, and (2) the actual use of financial services. Honohan (2005) included contribution of financial access to household wellbeing and firm productivity on demand side, while product/service design (usefulness for the poor), cost and information barriers to access on supply side. And, they used following financial access indicators:

1.   Payments: Inland and international remittances –crucial for the families dependent on migrant income.
2.   Savings mobilization (deposit services).
3.   Monitoring of users of funds (mechanisms for building credit worthiness)
4.   Transforming Risk (Insurance etc.)

Sarma (2010) considered 3 dimensions: penetration (number of bank accounts per adult population), availability (number of banking outlets (branches and ATMs) per 1000 population), and usage (volume of credit and deposit as proportion of GDP). Arora (2010) considered outreach, ease, and cost. Outreach is measured by branch and ATM penetration per area and population. Ease is measured by (a) minimum amount to open saving account; (b) minimum amount to maintain saving account; and (c) number of documents required to open bank account. Cost includes fees for different services offered by the bank. Here again, all the dimensions are related with banks only, and other financial services are left out in the

process. Gupte, Venkataramani and Gupta (2012) considered four dimensions, namely, outreach, usage, ease, and cost of transaction, which are combined taking geometric mean. Kunt and Klapper (2012) also measured financial inclusion using four indicators, *viz*., (1) formal accounts; (2) savings behavior; (3) sources of borrowing, purposes of borrowing, and use of credit cards; and (4) use of insurance products. Rahman (2013) considered four indicators, namely, convenient accessibility, take up rate, responsible usage, and satisfaction level. All are assigned equal weights adding to unity. Yorulmz (2013) followed the method suggested by Sarma (2008) and used multi-dimensional approach. Normalized inverse Euclidean distance from the ideal point for three dimensions, access, availability, and usage are considered. A summary of various Researcher/Social Scientists and variables used by them are presented below (Table 1).

Table 1: Summary of various researcher/social scientists and variables used

Researchers	Variables used
Beck, Kunt and Peria (2007)	(1) Access and possibility of use; and (2) Actual use
Honohan (2005)	1. Payments, 2. Savings mobilization, 3. Monitoring of users of funds and 4. Transforming Risk
The Consultative Group to Assist the Poor (2009)	1. Savings, 2. Payments, 3. Credit and 4. Delivery
Sarma (2010)	1. Penetration, 2. Availability and 3. Usage
Arora (2010)	1. Outreach, 2. Ease and 3. Cost
Rahman (2013)	1. Convenient Accessibility, 2. Take Up Rate, 3. Responsible Usage and 4. Satisfaction level.
Gupte, Venkataramani and Gupta (2012)	1. Penetration, 2. Availability, 3. Usage 4. Ease and 5. Cost.
Kunt, Klapper (2012)	1. Formal accounts (a. the mechanics of the use, b. purpose, c. barriers, d. alternatives to formal accounts, e. penetration and f. receipt of payments), 2. Savings behavior (a. use of accounts, b. use of community-based savings methods and c. the prevalence of savings goals), 3. Sources of borrowing, purposes of borrowing, and use of credit cards and 4. Use of insurance products
Yorulmz (2013)	1. Access, 2. Availability and 3. Usage
Credit Rating and Information System of Indian Ltd. (CRISIL) (2013)	1. Branch penetration, 2. Credit
Amberkhane *et al*. (2014)	Drag factors besides demand, supply and infrastructure

Amberkhane *et al.* (2014) considered drag factors besides demand, supply, infrastructure dimensions to construct FI index. On demand and supply sides the indicators are related banks, NBFCs and insurance with 50% weight to banks and 25% weight for each of the other two. On supply side, the indicators are about spread of branches or outlets. On demand side, the indicators are related to deposits, loans, remittances, density of SHGs, insurance penetration, etc. Infrastructure indicators are on irrigation, transport, power, literacy, and health. Drag factors considered are population growth, law and order situation, and corruption. The values of all indicators are normalized to converts values of indicators between 0 and 1 using formula below:

$$d_i = (A_i - m)/(M - m) \tag{1}$$

where, for i^{th} State

d_i is the normalized value of indicator.
A_i is the actual value of indicator.
M is maximum value of indicator.
m is the minimum value of indicator.

Then FI index is the Euclidean distance measured by using displaced ideal (D.I.) method. Financial inclusion index for r^{th} state was obtained by inverse normalized distance from the ideal as given below:

$$1 - \frac{\sqrt{\{(1 - s_r)^2 + (1 - d_r)^2 + (1 - i_r)^2\}}}{\sqrt{3}} \tag{2}$$

The term $\sqrt{\{(1 - s_r)^2 + (1 - d_r)^2 + (1 - i_r)^2\}}$ in (2) above is the Euclidean distance of the point (s_r, d_r, i_r), *i.e.* position of rth State from the ideal $(1, 1, 1)$ (This is the distance between the points S_r and P in Figure 1) and dividing it by $\sqrt{3}$ normalizes it, in three dimensional space. Further subtracting this from 1 (*i.e.* normalized distance of ideal point from the origin) gives inverse normalized distance, which is the index. This Index satisfies all intuitive properties of an index suggested by Nathan, Mishra, and Reddy (2008); namely Normalization, Anonymity, Monotony, Proximity, Uniformity, and Signalling.
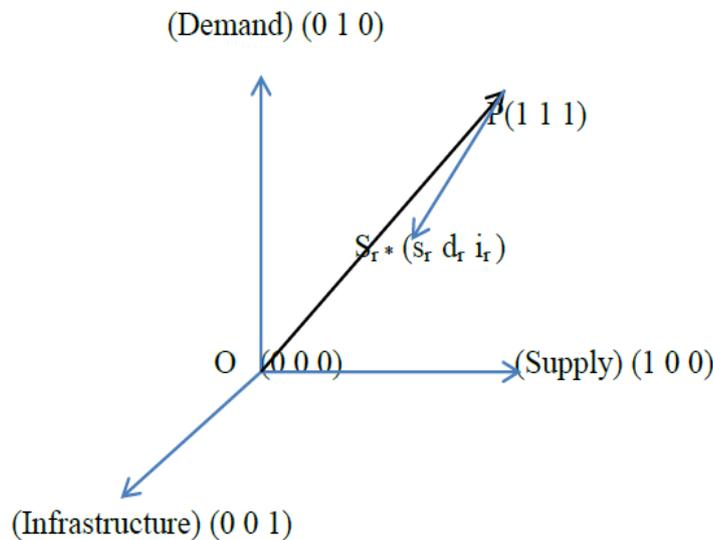

Figure 1: Diagrammatic representation of Euclidean distance method
Source: Nathan, Mishra and Reddy (2008)

The final Financial Inclusion Index is derived after applying the drag factors. Suppose D_r is the drag index for r^{th} state, the impact factor is taken as

$$1/(1 + D_r) \tag{3}$$

Comprehensive Final Inclusion Index is arrived at by multiplying impact factor as above with Financial Inclusion Index obtained earlier.

Points of difference with other methodologies

(1)   Method is like UNDP approach following multidimensional approach

(2)   This method uses Linear Averaging method for calculation of indices of Demand, Supply and Infrastructure dimensions, whereas Displaced Average Method is used for combining three indices.

(3)   Signalling characteristics of D.I. Method is considered more suitable to proposed index as it indicates unique optimal path to reach higher value. Moreover, the signalling characteristic implies that an improvement in a dimension that has lower value is more important than an equivalent improvement in a dimension that has a higher value. Methodology suggested is flexible as any other relevant factor or indicator identified can be added to any of the dimensions or in drag.

However, it is questionable if an index to measure a phenomenon shall include explanatory factors such as infrastructure related or drag factors. For instance, higher corruption may inhibit inclusion because of which the financial inclusion index may be lower in a state. We consider it inappropriate to multiply with drag factor. Even if inclusion of infrastructure dimension is justified, some indicators therein are about physical aspects of infrastructure. Certain others are proxies. For instance, female literacy cannot be taken as proxy for educational infrastructure. This is a methodological issue.

Goel and Sharma (2017) have used following parameters for constructing index:

- Banking Penetration (D1) - demographic branch penetration *i.e.*, number of accounts (deposits and loans) per 1,000 populations with different financial institutions (d1).
- Availability (D_2) of banking services – number of ATMs per 1,00,000 population (d_2).
- Number of bank branches per 1,00,000 population (d_3),
- Number of ATMs per 1,000 sq. km (d_4)
- Number of scheduled commercial banks per 1,000 sq. km (d_5).
- Access to Insurance (D3) – number of life insurance (LIC) offices (d_6).

The indicators are normalised, and indices are constructed using weights. The FII is measured as the simple average of two indices, X1 and X2, measured, respectively, based on distance from zero, and the ideal point, *w*, for each indicator.

$$d_d = W_d * (A_d - m_d)/(M_d - m_d) \tag{4}$$

where,

w_d = Weight attached to the dimension *d*, $1 \geq w_d \geq 0$;
A_d = Actual value of dimension *d*;
m_d = Minimum value of dimension *d*;
M_d = Maximum value of dimension *d*;
d_d = Dimensions of financial inclusion *d*.

$$X_1 = \frac{\sqrt{d_1^2 + d_2^2 + d_3^2 + \cdots + d_n^2}}{\sqrt{w_1^2 + w_2^2 + w_3^2 + \cdots + w_n^2}} \tag{5}$$

$$X_2 = 1 - \frac{\sqrt{(w_1 - d_1)^2 + (w_2 - d_2)^2 + (w_3 - d_3)^2 + \cdots + (w_n - d_n)^2}}{\sqrt{w_1^2 + w_2^2 + w_3^2 + \cdots + w_n^2}} \tag{6}$$

$$\text{FII} = \frac{1}{2}(X_1 + X_2) \tag{7}$$

Depending on the value of FII, the time period under study has been categorized as

1. $0 \leq FII \leq 0.4$; indicates low financial inclusion, LFI.
2. $0.4 < FII \leq 0.6$; indicates medium financial inclusion, MFI.
3. $0.6 < FII \leq 1$; indicates high financial inclusion, HFI.

From the computation of *FII* across a time period of twelve years, India can be categorized under low financial inclusion during 2005 to 2012. During this time period, the value of *FII* ranged between 0 - 0.4. During 2013, condition of financial inclusion improved, and India fell under medium financial inclusion with *FII* from 0.4 to 0.6. The objective of inclusive growth was achieved further during 2014-2015 and India fall under high financial inclusion range in this time period. The value of *FII* ranged from 0.6 to 1. Unlike earlier studies where only indices such as banking penetration, availability of banking services and usage of banking system were used, Goel and Sharma (2017), included indicators such as access to savings and access to insurance also. Also, *FII* is constructed for a longer period of twelve years.

Sriram and Sundaram (2015) measured *FII* using 3 dimensions, *viz.*, access, availability, and usage. These dimensions are assigned weights of 1 for access and 0.5 each for the remaining two. Access is measured through number of bank accounts in the area, availability, through number of access points (branches, ATMs, banking correspondents) in the area, and, usage, through number of accounts (savings, deposits, loan and credit) held by respondents. These dimensions are combined to compute FII as the difference of square root of Euclidean distance with reference to the ideal (*i.e.* weight) from unity. The formula is as below:

$$FII = 1 - sqrt\{[(1 - P_i)^2 + (0.5 - A_i)^2 + (0.5 - U_i)^2] / 1.5\} \tag{8}$$

where,

FII = Financial Inclusion Index
P_i = Access
A_i = Availability
U_i = Usage

Sarma (2008) has computed the values of IFI for 54 countries using the three basic dimensions of financial inclusion–accessibility, availability and usage of banking services. Accessibility has been measured by the penetration of the banking system proxied by the number of bank A/C per 1000 population. Availability has been measured by the number of bank branches and number of ATMs per 100,000 people. The proxy used for the usage dimension is the volume of credit plus deposit relative to the GDP. Gupte et al. (2012) considered 4 dimensions, outreach, usage, ease and cost. Outreach has two sub-dimensions, penetration, and availability. Ease too has two, directly related, and inversely related. Total 5 indicators were included, and no indicators were considered for ease and cost dimensions.

Demirguc-Kunt and Klapper (2012) delineated the methodology and computing Global Findex which measured the use of financial services (demand) as opposed to the access (supply) to them. Several indicators were used for computing Findex. The first set of indicators focuses on formal accounts; the mechanics of the use of these accounts (frequency of use, mode of access); the purpose of these accounts (personal or business, receipt of payments from work, government, or family); barriers to account use; and alternatives to formal accounts (mobile money). The account penetration indicator measures individual or joint ownership of formal accounts—accounts at a formal financial institution such as a bank, credit union, co-operative, post office, or microfinance institution. It includes those who report having a debit or ATM card tied to an account. Indicators relating to the receipt of payments measure the use of formal accounts to receive wages (payments for work or from selling goods), payments or money from the government, and family remittances (money from family members living elsewhere). The second set of indicators focuses on savings behaviour. This relates to the use of accounts, as people often save at formal financial institutions. Other indicators explore the use of community-based savings methods and the prevalence of savings goals. The third set focuses on sources of borrowing (formal and informal); purposes of borrowing (mortgage, emergency or health purposes, and the like); and use of credit cards. The fourth focuses on use of insurance products for health care and agriculture.

Most of the above are at country level and one or two are there for states. Credit Rating and Information Services of Indian Ltd (CRISIL) (2013) calculated index, Inclusix, available at district level. It considered three dimensions, namely branch penetration, credit penetration and deposit penetration. However, it has serious limitations in terms of coverage of dimensions and indicators. It is only in terms of number of accounts and not amount. Further, it covers scheduled commercial banks data only.

Mehrotra *et al*. (2009) also built up an index for financial inclusion using similar kind of aggregate indicators like number of rural offices, number of rural deposit accounts, volume of rural deposit and credit from banking data for sixteen major states of India. Here also, Financial Inclusion Index is estimated at the district level in India.

8.   Issues/Limitations with Existing Measures

Whatever existing measures were used so far, they had some issue or the other to be resolved/improved upon. Some of them are as under:

•   Mostly based on secondary and administrative data though 'demand side' and 'usage' based indicators are incorporated. Exceptions like Findex exist

- Large scale survey-based data not used. Again, Findex is an exception. There too, the sample for any individual country is limited and representative at country level only.
- Mix up between indicators and their drivers is an issue. The question is should the financial inclusion index should combine indicators of access and/or use as well as factors influencing these indicators, together.
- Many dimensions and large number of indicators are available. Should there be any standardization and consensus on indicators?

9.   Index Based on NAFIS data

To take care of some of the limitations of the existing measures, we have tried to build an index, NAFINDEX, based on NABARD Rural Financial Inclusion Survey (**NAFIS)** 2016-17 data. NAFIS was undertaken by NABARD pan-India during 2016-17 covering both financial and livelihood aspects of 40000 sample households across 29 states. The survey covered all aspects of financial inclusion from a household perspective, *viz.*, savings, borrowing, investment, remittances and payments, and insurance. Besides, the survey also covered financial literacy and experience of households with payment mechanisms.

The index is generated at all India and state-level based on the field level data collected from households. For constructing NAFINDEX, we covered three dimensions – traditional banking products (*T*), modern banking services (*M*), and payment mechanisms (P). Traditional banking products covered savings, investments, loans, and others (insurance & pension); modern banking services included usage level of ATMs, internet banking, and mobile banking; and, payment mechanisms covered usage of cheque and credit/debit card as well as ease of using them. The indicators used and weights assigned for this Index are given in Table 2.

Table 2: Indicators used for constructing NAFINDEX

Dimension	Service/sub-dimension	Indicator	Symbol of normalised indicator	Weight
Traditional Banking Products	Savings	% households that made any saving in the last 1 yr	$T11$	0.125
		mean savings (with all agencies) per household in the last 1 year [base: saver household who reported their saving amount]	$T12$	0.125
	Investment	% households that made any investment in the last one year	$T21$	0.125
		mean investment in all assets for household reporting any investment in the last one year	$T22$	0.125
	Loans	incidence of indebtedness	$T31$	0.125
		average outstanding debt per indebted household (rs.)	$T32$	0.125
	Others	% households with at least one member having any insurance	$T41$	0.125
		% households having pension	$T42$	0.125

Modern Banking services	usage	% ATM users	$M11$	0.167
		% internet banking users	$M12$	0.167
		% mobile banking users	$M13$	0.167
	Ease in using	% users having ease of using ATM	$M21$	0.167
		% users having ease of using internet banking	$M22$	0.167
		% users having ease of using mobile banking	$M23$	0.167
Payment Mechanisms	usage	% users of cheque	$P11$	0.25
		% users of debit/credit card	$P12$	0.25
	Ease in using	% users having ease in using cheque	$P21$	0.25
		% users having ease in using debit/credit card	$P22$	0.25

The indicators are combined to form dimension indices which are in turn combined into NAFINDEX. The values of all indicators are normalized to scale down values of indicators between 0 and 1 using formula at (1). Individual dimension indices are computed as below:

$$T_n = \sum(W_{ij}*T_{ij})$$
$$M_n = \sum(W_{ij}*M_{ij})$$
$$P_n = \sum(W_{ij}*P_{ij})$$

where,
T_n is the dimension index for traditional banking products for nth state;
M_n is the dimension index for modern banking services; and,
P_n is the dimension index for payment mechanisms.

Subscripts i and j stand for sub-dimension and indicator, respectively.

$$\text{NAFINDEX} = \sqrt[3]{(T_n*M_n*P_n)}$$

We have fitted a linear regression model to understand the explanatory factors for variation of NAFINDEX across states.

Dependent variable: NAFINDEX = Financial Inclusion Index

Independent variables:

Mf-membership	= index of per cent HH having membership with microfinance institutions
% trained	= proportion of HH received training
income index	= index of HH income
% institutional loan	= share of institutional loan in total

The regression is worked for agricultural households, non-agricultural households and all rural households.

10.   State-wise NAFINDEX Values

The state wise Index of *FI* calculated based on NAFIS data are given in Table 3. The NAFINDEX for all India is 0.337 in a scale of 0 to 1. The value of the index for banking products dimension is 0.307. The value for the payment mechanisms dimension is the highest at 0.370 followed by 0.345 for banking services. Punjab, Kerala, and Karnataka ranked top three states in banking products dimension while Bihar, Chhattisgarhi, and Madhya Pradesh are at the last three positions. Goa, Manipur, and Nagaland are at the top for banking services dimension and Jharkhand, Madhya Pradesh, and Meghalaya are at the bottom. For the payment mechanisms dimension, top ranking states are Goa, Assam, Manipur, and Tripura while Uttarakhand, Rajasthan, and Chhattisgarhi are at the bottom.

Table 3: NAFINDEX values for different states and all India

State	Banking products	Rank	Banking Services	Rank	Payment mechanism	Rank	NAFINDEX	Rank
Goa	0.472	5	0.946	1	0.761	1	0.600	1
Punjab	0.617	1	0.473	12	0.383	19	0.486	2
Karnataka	0.533	3	0.430	14	0.438	13	0.483	3
Telangana	0.482	4	0.563	8	0.478	8	0.480	4
Andhra Pradesh	0.424	7	0.703	4	0.529	5	0.473	5
Kerala	0.609	2	0.446	13	0.362	21	0.470	6
Manipur	0.385	12	0.791	2	0.558	3	0.464	7
Tripura	0.366	14	0.523	10	0.558	3	0.452	8
Jammu & Kashmir	0.420	8	0.427	15	0.450	12	0.435	9
Odisha	0.379	13	0.381	24	0.477	9	0.425	10
Haryana	0.409	10	0.328	26	0.423	14	0.416	11
Mizoram	0.322	16	0.580	6	0.476	10	0.392	12
Assam	0.237	21	0.482	11	0.625	2	0.385	13
Himachal Pradesh	0.460	6	0.565	7	0.310	23	0.377	14
Meghalaya	0.318	17	0.240	29	0.403	17	0.358	15
Arunachal Pradesh	0.337	15	0.353	25	0.374	20	0.355	16
Sikkim	0.253	20	0.678	5	0.486	7	0.351	17
Nagaland	0.318	17	0.734	3	0.325	22	0.322	18
West Bengal	0.202	25	0.419	16	0.507	6	0.320	19
Maharashtra	0.224	22	0.416	18	0.416	16	0.305	20
Jharkhand	0.200	26	0.321	27	0.451	11	0.301	21
Gujarat	0.215	24	0.531	9	0.420	15	0.300	22
Uttar Pradesh	0.217	23	0.417	17	0.397	18	0.294	23
Tamil Nadu	0.387	11	0.404	20	0.208	25	0.284	24
Uttarakhand	0.420	8	0.401	21	0.189	27	0.281	25
Bihar	0.198	27	0.387	23	0.264	24	0.229	26

State	Banking products	Rank	Banking Services	Rank	Payment mechanism	Rank	NAFINDEX	Rank
Rajasthan	0.276	19	0.398	22	0.178	28	0.222	27
Madhya Pradesh	0.141	29	0.266	28	0.195	26	0.166	28
Chhattisgarh	0.160	28	0.411	19	0.055	29	0.094	29
All India	0.307		0.345		0.370		0.337	

Table 4 gives results of linear regression model estimated to explain the variation in NAFINDEX. Of the four variables included in the model two variables Mf-membership and income index are significant for agricultural, non-agricultural and overall rural households. Proportion of households trained has significant effect on NAFINDEX. That is, states where the penetration of microfinancing institution is higher and where households reported higher income, the financial inclusion index is also higher. The NAFINDEX among non-agricultural households is higher in states with higher proportion of households with trained households. The explanatory of power the regression is 48 to 55 per cent and is statistically significant.

Table 4: Factors explaining variation in NAFINDEX

Variable/description	Particular	Agri HH	Non-Ag HH	Rural HH
Constant	*Coefficient*	**0.252247 *****	**0.140434 *****	**0.211313 *****
	std error	0.0518705	0.0486343	0.046158
	p - value	<0.0001	0.0081	0.0001
Mf-membership *(index of per cent HH having membership with microfinance institutions)*	*Coefficient*	**0.204269 *****	**0.232292 *****	**0.219316 *****
	std error	0.0573099	0.0708419	0.0646751
	p - value	0.0016	0.0032	0.0024
% trained *(proportion of HH received training)*	*Coefficient*	**−0.00254901**	**0.186124 *****	**0.0588672**
	std error	0.0683906	0.0720409	0.0693977
	p - value	0.9706	0.0163	0.4047
income index *(index of HH income)*	*Coefficient*	**0.243671 *****	**0.165032 ****	**0.294322 *****
	std error	0.0768699	0.0841741	0.0831651
	p - value	0.0041	0.0616	0.0017
% institutional loan *(share of institutional loan in total)*	*Coefficient*	**−0.0352766**	**0.102054**	**−0.0385928**
	std error	0.0826278	0.073567	0.0792173
	p - value	0.6732	0.1781	0.6306
Note: ***, ** significant at 1% and 5%, respectively				
Mean dependent var		0.346811	0.365558	0.362676
Sum squared residual		0.136775	0.208367	0.168062
R-squared		0.478384	0.546915	0.499992
F(4, 24)		5.502705	7.242553	5.999799
Log-likelihood		36.52308	30.41914	33.5362

11. Conclusion

Based on the field level data collected through NAFIS 2016-17, NAFINDEX has been constructed for different states of India. Three dimensions, traditional banking products, modern banking products, and payment systems, are considered for constructing the index. The average value of index at all India is 0.337. There are variations across states in the value of NAFINDEX and dimension indices. Interestingly, many states which saw lower penetration of traditional banking products as reflected in the respective dimension index, the modern banking products and payment mechanisms showed higher values. This underlines the direction for the future banking   expansion in hither to unreached states.

Acknowledgements

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